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NOTES ON NEARCTIC *SYLVICOLA* (DIPTERA: ANISOPODIDAE)[1]

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Abstract.—Based on distinct morphological characters, the five Nearctic species of *Sylvicola* Moses Harris are divided into two subgenera: *Sylvicola* (*Sylvicola*) which includes *alternatus* (Say) and *fenestralis* (Scopoli); and *Sylvicola* (*Anisopus*) which contains *fuscatus* (Fabricius), *notialis* Stone, and *punctatus* (Fabricius). A key is presented for identifying these species with illustrations of wings, male terminalia, and palpi. New seasonal and distributional data are noted. The larva and pupa of *Sylvicola alternatus* are described and illustrated. A new technique for collecting adults with molasses traps is described.

Adult window flies in the genus *Sylvicola* Moses Harris have been occasionally reported as minor pests as they try to escape from buildings. The majority of specimens have been taken under such circumstances or during routine sweeping. From their rather poor representation in many collections throughout this country, one could easily believe that they are uncommon to rare. Such a view would be at least partially incorrect, as the authors have succeeded in trapping adults of several species of *Sylvicola* in Georgia during the cool months of the year. The immatures which normally develop in decaying organic material have received increasing attention the past 30 years as their involvement in facultative myiasis (James, 1948; Smart, 1956; Morris, 1968; and Smith and Taylor, 1966) and in sporadic infestations at waste disposal plants (Smart, 1956 and Hickin, 1974) has become better known.

The papers of Baerg (1918), Alexander (1919, 1942, 1965), Edwards (1923, 1928), Lindner (1930), Abdul-Nasr (1950), Freeman (1950), and Stone (1965) have greatly increased our knowledge with regard to taxonomy, biology, morphology, and distribution of these flies. However, few illustrations have

[1] The contents of this paper reflect the personal views of the authors and are not to be construed as a statement of official Air Force policy.

been published of the wings and male terminalia. Therefore, in the present paper such figures have been provided, together with a proposal that the genus be subdivided into two subgenera on the basis of distinct morphological characters found in the wing and the male terminalia. The larva and pupa of *Sylvicola alternatus* (Say) are described for the first time.

Taxonomy

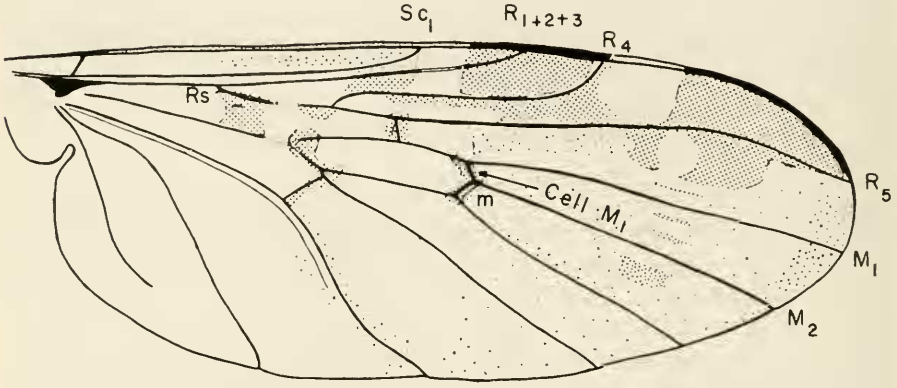
Species of *Sylvicola* are generally recognized as small flies 4 to 7 mm long with spotted wings, compact 16-segmented antennae, stocky bodies, and short blunt abdomens. They differ from other Nematocera by the following combination of characters: Three ocelli, mesoscutum without V-shaped transverse suture, wing with three branches of R and three branches of M reaching margin, discal cell present, Cu_1 and IA present, wing membrane with numerous microtrichia, and hind tibia with a comb of short spinules on the posterodorsal surface. The male genitalia are unusual in having three conspicuous penis rods spirally coiled basally as illustrated by Cole (1927). The female has a single spermatheca. *Mycetobia* Meigen has two spermathecae, and *Trichocera* Meigen has three spermathecae; the former is in the family Anisopodidae, the latter in the family Trichoceridae.

There are two divisions of *Sylvicola* in the Nearctic Region worthy of subgeneric rank as noted below.

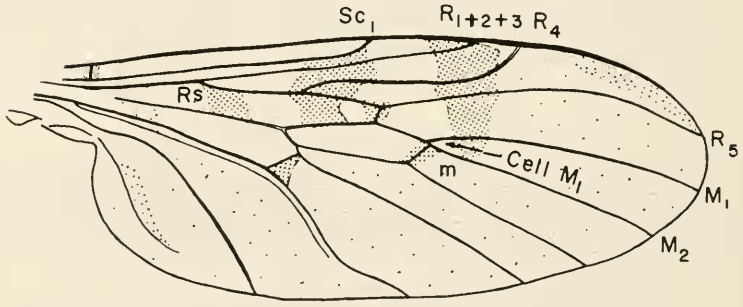
The following abbreviations indicate the location of specimens: CU, Cornell University, Ithaca, New York; MU, University of Minnesota, St. Paul, Minnesota; PC, H. D. Pratt Collection, Atlanta, Georgia; UGa, University of Georgia, Athens, Georgia; and USNM, U.S. National Museum, Washington, D.C.

Key to the Nearctic Subgenera and Species of *Sylvicola*

1. Cell M_1 pointed at base, *m* cross-vein connecting with M_{1+2} at base (Fig. 2); male genitalia with basal ring deeply concave ventrally; filament of claspette slender, somewhat S-shaped; sternum 10 with 2 fingerlike lobes, partially fused at base medially (Figs. 3, 4, 5) ..... subgenus *Anisopus* Meigen ... 2
– Cell M_1 truncated at base, *m* cross-vein connecting with M_2 some distance beyond base (Fig. 1); male genitalia with basal ring not deeply concave ventrally; dististyle clawlike or rodlike; sternum 10 broad, hoodlike (Figs. 6, 7) .. Subgenus *Sylvicola* Moses Harris ... 4
2. No infuscation behind stigmal spot in Cells R_4 and R_5; basistyle with hairy, fingerlike lobe near apex (Fig. 3) ..... *fuscatus* (Fabricius)
– A dark marking in Cell R_5 behind stigmal spot and often in Cell R_4 near wing tip; basistyle without a fingerlike lobe (Figs. 4, 5) 3
3. Costal cell hyaline with microtrichia sparse in 1 or 2 rows, with only a few microtrichia basad of origin of Rs; eyes of male touching; male



1· ALTERNATUS



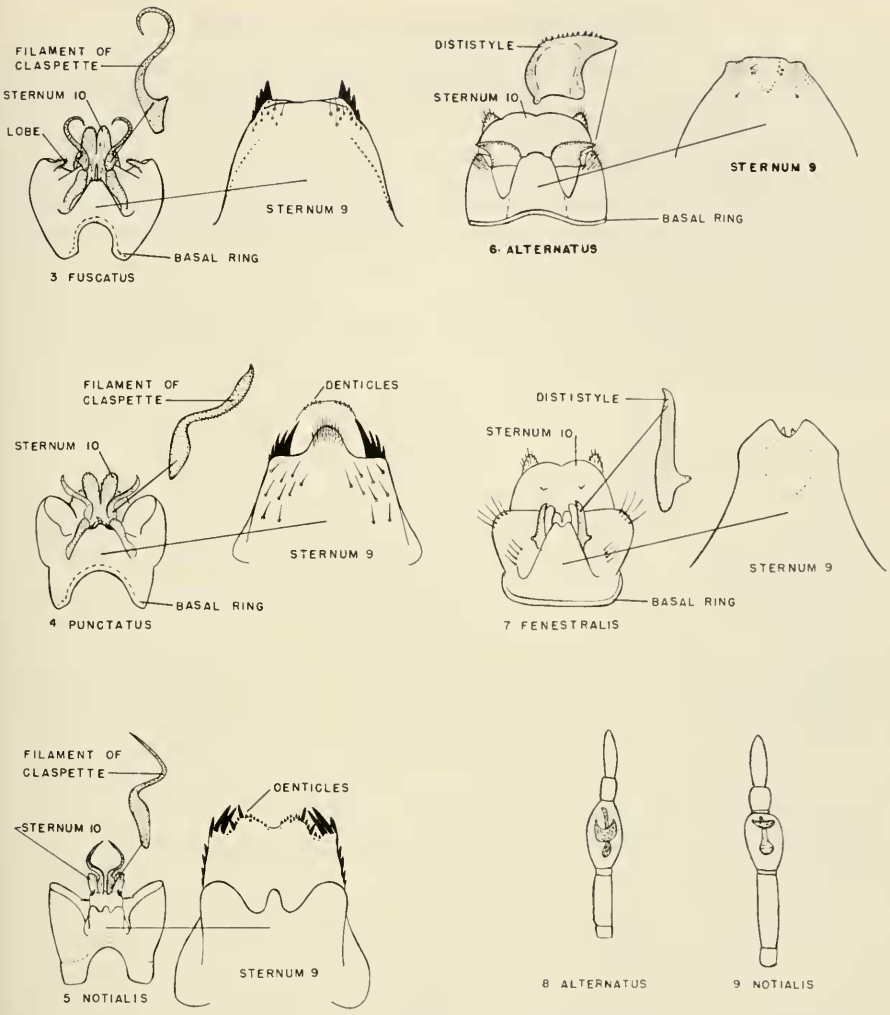
2· PUNCTATUS

Figs. 1–2. Wings. 1, *Sylvicola alternatus*. 2, *S. punctatus*.

genitalia (Fig. 4) with filament of claspette straplike, with margin serrate; membranous margin of sternum 9 with 2 submedian groups of denticles few in number (4 to 11 on each half), smaller, less sclerotized and pigmented ..... *punctatus* (Fabricius)

– Costal cell somewhat infuscated with microtrichia abundant, in at least 2 or 3 rows, extending basad of origin of Rs; eyes of male slightly separated; male genitalia (Fig. 5) with filament of claspette slender, without marginal serrations; membranous margin of sternum 9 with two submedian groups of denticles more numerous (12 to 15 on each side), larger, more sclerotized and pigmented .... *notialis* Stone

4. Pale spot in outer radial field white, clearly delimited (Fig. 1); median



Figs. 3–7. Male genitalia. 3, *Sylvicola fuscatus*. 4. *S. punctatus*. 5, *S. notialis*. 6, *S. alternatus*. 7, *S. fenestralis*. Figs. 8–9. Female palpus. 8, *S. alternatus*. 9. *S. notialis*.

mesonotal stripe divided; eyes of male touching; male genitalia with dististyle stout and clawlike; sternum 9 with apex convex or weakly trilobed (Fig. 6) ..... *alternatus* (Say)

– Pale spot in outer radial field dirty white, its limits less sharply defined; median mesonotal stripe not divided; eyes of male rather widely separated; male genitalia with dististyle rodlike with basal tooth; sternum 9 with apex notched (Fig. 7) ..... *fenestralis* (Scopoli)

Sylvicola subgenus *Sylvicola* Moses Harris

Sylvicola Harris, 1776, An Exposition of English Insects, etc., Decad III, p. 100. Type-species, *brevis* Harris (designated by Coquillett, 1910: 610) = *fenestralis* (Scopoli), 1763.

Cell M_1 truncated at base, *m* cross-vein connecting M_2 some distance beyond base (Fig. 1); male terminalia with basal ring not deeply concave ventrally; sternum 10 large and hoodlike; and clasper function assumed by a clawlike or rodlike dististyle (Figs. 6, 7). Second segment of palpus shorter than enlarged 3rd segment (Fig. 8).

This subgenus in the Nearctic Region includes the type-species *fenestralis* (Scopoli) and *alternatus* (Say).

Sylvicola (Sylvicola) alternatus (Say)

Rhyphus alternatus Say, 1823, J. Acad. Nat. Sci. Philad. 3: 27.

Recorded by Stone (1965) from B.C., Conn., Fla., Ga., Idaho, Kans., Maine, Md., Mass., Mich., Mo., N.H., N.J., N.Y., N.C., Ohio, Ont., Oreg., Pa., P.E.I., Que., R.I., S.C., Tex., Va., Wash., W.Va., and Wis. The following add new state records for Alabama, Minnesota, Tennessee, and Vermont. ALABAMA: 1 ♀, Montgomery, June 1947, H. R. Dodge (USNM); 1 ♂, Montgomery, June 13, 1947, H. R. Dodge (USNM); 1 ♀, Montgomery, Dec. 8–12, 1946, rabbit viscera trap, G. E. Quinby (USNM). MINNESOTA: 1♀, Olmstead Co., (MU); 1 ♀, Wabasha, May 24, 1941, light trap, H. T. Peters (MU). TENNESSEE: 1 ♀, Greenbriar, Great Smoky Mt. National Park, May 16, 1970, W. J. Cloyd (PC). VERMONT: 1 ♀, Laurel Lake, Jacksonville, Windham Co., June 8, 1973, in molasses trap, GKP (PC); 3 ♀, Laurel Lake, Jacksonville, Windham Co., May 23, 1976 HDP (PC). The following specimens from Georgia have been studied: 1 ♂, Atlanta, Nov. 26, 1946, P. W. Fattig (UGa); 3 ♀, Athens, April 12–26, 1969, in malaise trap, R. and J. Mathews (UGa); 6 ♂, Bogart, March 7, 1973, A. Lavallee (UGa); 2 ♀, Clark Co., GKP (PC); 1 ♀, Upper Falls, Desoto St. Park, April 28, 1973, GKP (PC).

Hundreds of specimens, both in alcohol and mounted on points, were collected in molasses traps in Atlanta, during the cool months from October to June in the eight year period 1972–1979. None have been collected in July, August, and September. The peak collections of males and females in molasses traps (over 50 on March 29, 1974) were made on warm, sunny days with little breeze and temperatures in the range of 10°C to 25°C. No activity was observed when temperatures were below 10°C. One male was collected in Atlanta, March 2, 1975 in a fish-baited trap. Two males and one female were collected at Woodbury, New Jersey in a molasses trap, Feb. 29–March 2, 1976, GKP (PC). One male and one female were collected in a molasses trap at the Briedenthal Reservation, Douglas Co, Kansas, Nov. 4–18, 1977, G. W. Byers (PC).

Sylvicola (Sylvicola) fenestralis (Scopoli)
Fig. 7

Tipula fenestralis Scopoli, 1761, Ent. Carn., p. 322.

Recorded by Stone (1965) from Calif., Conn., Idaho, Maine, Mass., N.H., N.J., N.Y., N.S., Ohio, Oreg., Pa., Que., R.I., Wash., England, China, Norway, Germany, and Sweden. The following represent the first collection records from Vermont. VERMONT: 5 ♀, Laurel Lake, Jacksonville, Windham Co., June 8–12, 1973; 1 ♀, Halifax Gorge, Windham Co, May 26, 1974, G. K. Pratt (PC).

The drawing of the male terminalia (Fig. 7) was made from two males in the U.S. National Museum Collection with the following data: Ilwaco, Wash., Aug. 27, 1927, A. L. Melander; Was (probably the state of Washington), J. M. Aldrich.

Sylvicola subgenus *Anisopus* Meigen

Anisopus Meigen, 1803, Mag. f. Insectenkunde 2: 264. Type-species, *fuscus* Meigen (designated by Coquillett, 1910: 507) =*fuscatus* (Fabricius), 1775.

Cell M_1 pointed at base, *m* cross-vein connecting M_{1+2} at base (Fig. 2); male terminalia with basal ring deeply concave ventrally; sternum 10 partially divided at tip into narrow fingerlike lobes; clasper function assumed by filament of claspette (Stone, 1965) as shown in Figs. 3, 4, 5. Second segment of palpus longer than enlarged 3rd segment (Fig. 9). This subgenus includes in the Nearctic Region the type-species *fuscatus* (Fabricius), *punctatus* (Fabricius), and *notialis* Stone.

At various times in the past, information on these flies has been published under the generic names *Phryne* Meigen, 1800; *Anisopus* Meigen, 1803; and *Rhyphus* Latreille, 1804.

Sylvicola (Anisopus) fuscatus (Fabricius)
Fig. 3

Tipula fuscatus Fabricius, 1775, Systema Entomologiae, p. 755.

Recorded by Stone (1965) from Alaska, N.H., N.Y., N.C., Ont., and Wash. The following specimen constitutes a new state record. VERMONT: 1 ♀, Laurel Lake, Jacksonville, Windham Co., July 10, 1973, G. K. and H. D. Pratt, in molasses trap. The drawing of the male genitalia (Fig. 3) was made from a specimen in the U.S. National Museum from Fairbanks, Alaska, Aug. 21, 1945, C. E. Prince, #16.

Sylvicola (Anisopus) notialis Stone
Fig. 5

Sylvicola notialis Stone, 1965, Proc. Entomol. Soc. Wash. 67 (3): 150–151.

Holotype male from Dallas, Texas, in USNM.

Recorded by Stone (1965) from Ark., Fla., La., Tex., and Va. The following represent the first state records for Alabama, Georgia, and Kansas. ALABAMA: 1 ♂, Florence, Oct. 1946, H. R. Dodge (PC); 1 ♀, Montgomery, Nov. 8–11, 1946, fly trap baited with feces, H. R. Dodge (USNM); 1 ♀, Montgomery, Dec. 8–12, 1946, G. E. Quinby, fly trap baited with rabbit viscera (USNM); 1 ♂, Montgomery, Jan. 21, 1947 (PC); 2 ♀, Montgomery, June 23, 1947, H. R. Dodge (PC, USNM); 1 ♂, Montgomery, June 13, 1947, H. R. Dodge (USNM). GEORGIA: 30 ♀, 6 ♂ from molasses traps, Atlanta, October to April 1972–1978 (none in warmer months) HDP (PC); 1 ♀, molasses trap, Big Creek at Old Lexington Road, Clarke Co., April–May 1973, GKP (PC); 1 ♂, Savannah, privy trap, Dec. 1953, J. W. Kilpatrick. KANSAS: 2 ♂, 8 ♀, Breidenthal Reservation, Douglas Co., molasses trap, Nov. 4–18, 1977, G. W. Byers (PC); 1 ♀, New Orleans, LA, March 18, 1943, light trap, D. G. Denning (MU).

Sylvicola (*Anisopus*) *punctatus* (Fabricius)
Fig. 4

Rhagio punctatus Fabricius, 1787, Mantissa Insect. 2: 333.
Rhyphus marginatus Say, 1823, J. Acad. Nat. Sci. Philad. 3: 27 (Synonymy by Stone, 1965: 149).

Recorded by Stone (1965) from Alta., Ill., Ind., Kans., Maine, Md., Mass., Mich., Mo., N.B., N.H., N.J., N.Y., Ont., Pa., Que., R.I., Vt., Va., W.Va., Wis., England, France, Germany, and Sweden. The following add new state records from Georgia, Minnesota, and Ohio. GEORGIA: 1 ♀, Ray's Corner, Oconee Co., Jan. 25, 1972, on windowpane, GKP (PC). MINNESOTA: 1 ♀, Anoka Co., April 27, 1940, W. Connell, reared from cow dung (MU); 1 ♂, Anoka Co. (MU); 2 ♀, Anoka Co. (MU); 1 ♂, Coon Creek, April 25, 1936, A. B. Gurney, pupa skin attached, Emerged May 2, 1936 (MU); 5 ♂, Olmstead Co. (MU); 1 ♂, 1 ♀, Moose Lake, Carlton Co. (MU); 1 ♀, Washington Co., St. Anthony Park (MU); 50 ♀, 25 ♂, Wabasha, light trap, H. T. Peters, May to October, 1940 and 1941 (MU, PC). OHIO: 1 ♂, Columbus, July 27, 1947, H. E. Milliron (MU). Additional specimens studied include: 2 ♀, Cold Spring Harbor, L. I., New York, June 15, 1921, S. H. Emerson (MU); 1 ♂, Ithaca, New York, at light, July 9, 1937, P. Babiy (CU); 1 ♂, London, Ontario, Canada, June 30, 1956, W. W. Judd (USNM); 1 ♂, Pa. State College, Pennsylvania, Oct. 15, 1956, S. W. Frost (USNM); 2 ♂, 4 ♀, Laurel Lake, Jacksonville, Windham Co., Vermont, in molasses traps, May 23 to Sept. 19, 1975, HDP (PC); 2 ♂, 1 ♀, Woodbury, New Jersey, Feb. 29–March 2, 1976, GKP (PC).

Collecting Techniques

Many males and females of *S. punctatus* and one female of *S. alternatus* were collected in light traps at Wabasha, Minnesota. One *S. notialis* was

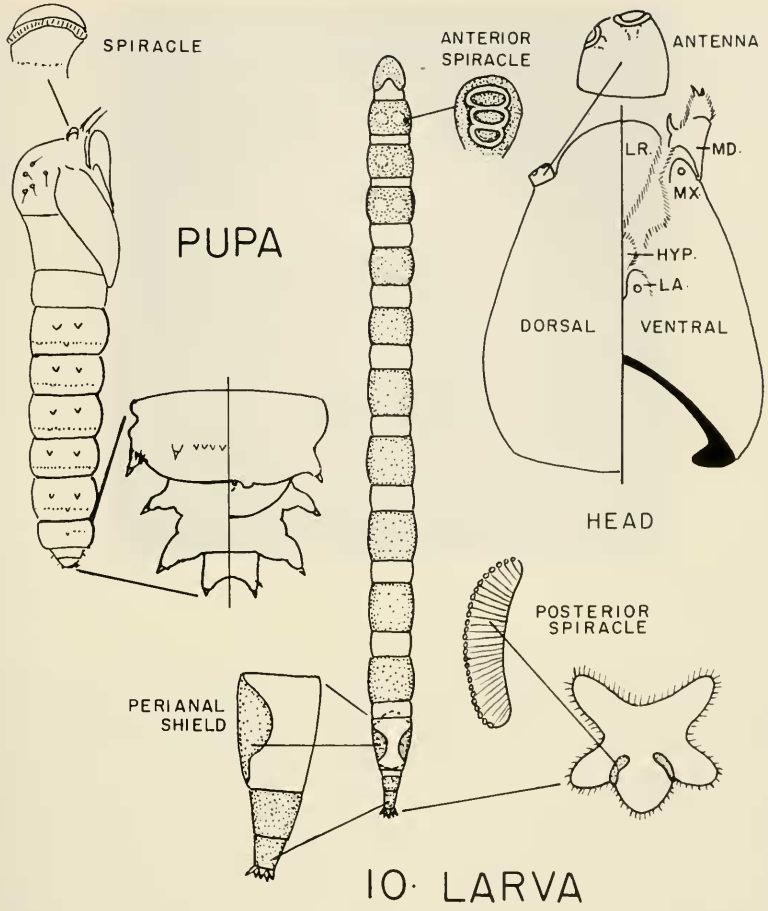


Fig. 10. *Sylvicola alternatus*, pupa and larva. LR = labrum; MD = mandible; MX = maxilla; HYP = hypopharynx; LA = labium.

collected in a light trap at New Orleans, Louisiana. Three females of *S. alternatus* were collected in malaise traps at Athens, Georgia. Standard CDC fly traps baited with dog manure or rabbit viscera caught male and female *S. notialis* at Florence and Montgomery, Alabama, while one baited with fish collected a male of *S. alternatus* at Atlanta, Georgia. Some specimens of the type-series of *S. notialis* were reared from cow manure at Panama City, Florida. One female of *S. punctatus* was reared from cow dung in Minnesota. Comstock (1947) reported collecting adults at sugar baits.

The authors have developed a simple, new technique for trapping adult *Sylvicola*, hereafter called a "molasses trap." This trap was previously used

Fig. 11. Molasses trap.

by Curt Dunn of the University of Georgia and John Bouseman of the Illinois Natural History Survey (personal communication) who "got the idea to try the traps from an article by A. B. Champlain and J. N. Knull (1932) and . . . an article by S. W. Frost and H. Dietrich (1929)." The molasses trap consists of a gallon plastic milk jug with half the sides cut away and the bottom portion holding about an inch of molasses diluted one part to four parts of water (Fig. 11). Females of all five Nearctic species of *Sylvicola* have been collected in the molasses traps: *S. alternatus* and *S. notialis* in Atlanta and Athens, Georgia; and *S. alternatus*, *S. fenestralis*, *S. fuscatus*, and *S. punctatus* in Jacksonville, Vermont. Males of *S. alternatus* were collected in molasses traps in Atlanta, Georgia and Woodbury, New Jersey; of *S. notialis* in Atlanta, Georgia; and of *S. punctatus* in Jacksonville, Vermont. These traps yielded 1 to 50 specimens a day in areas where routine sweeping with an insect net was unsuccessful in collecting a single specimen. The largest collection from a molasses trap was made on March 29, 1974, at Atlanta, Georgia when at least 50 males and females *S. alternatus* were collected.

Biology

Alexander (1919, 1942) noted that the immature stages "occur in or near decaying organic matter as in manure and fermenting sap." The best ac-

count of the life history of *Sylvicola* known to the authors is that of Keilin and Tate (1940). They summarized previous accounts, studied all stages and described the eggs, larvae, and pupae of *Anisopus*, now *Sylvicola, fenestralis* and *punctatus*. Their account of the life history, larvae, and pupae is similar to that of a small series of *S. alternatus* reared in Atlanta, Georgia described below.

Beginning March 11, 1974, live adults of *S. alternatus* taken from a molasses trap were placed in water to remove the molasses and then transferred to paper toweling in glass jars. Some females laid masses of 12 to 40 eggs on apple wedges an inch or two long, sometimes within six hours after being collected. None of these egg masses laid on apple wedges above the water level hatched. On March 29, when the largest collection was made from the molasses trap, at least 20 adults were transferred to paper toweling. At 12:30 PM, one pair was observed mating in the jar, male and female facing in opposite directions in the fashion of *Culex pipiens* Linnaeus. They remained *in copula* for 40 minutes, until 1:10 PM in a room with temperature about 20°C. None of these eggs hatched, possibly because the eggs were not in contact with water. In another jar, females were introduced on April 5. Some of the apple wedges were left floating in water amid a mass of soft facial tissue. On May 4, small larvae were seen swimming in a serpentine manner. Subsequently larvae of three sizes were found and some were preserved in alcohol or mounted on slides. The smallest larvae, which may be Stage II, averaged 6 mm; the middle sized larvae, which may be Stage III, averaged 9–10 mm; and the largest, possibly Stage IV, averaged 11–12 mm. The largest larvae migrated from the slimy apple wedges to drier parts of the facial tissue projecting above the water surface in the jar beginning May 5 and 6, and began to pupate May 9 and 10. Adults emerged five to six days later. A total of nine adults were successfully reared. Thus, at room temperature of about 20°C in Atlanta, Ga., the life cycle was completed in four to five weeks.

Larval Taxonomy

The live larva of *S. alternatus* is mottled pinkish purple, with five anal gills, and conspicuous soft membrane between the body segments. The antennae are very short. The ventral surface of the head has short rows of very fine microsetae (no basal socket is present, as in true setae) as shown in the drawing in Keilin and Tate (1940) or James (1948). The larva has a "transparent shield-shaped area on the eighth abdominal segment" labeled *an. s.* in figs. 17, 31, and 32 of Keilin and Tate (1940), which is also illustrated in Smith and Taylor (1966) and Zumpt (1965). This structure is labeled "perianal shield" in Fig. 10, following the terminology of James (1948). The

perianal shield and the five fleshy lobes at the tip of the body may furnish useful taxonomic characters for separating *Sylvicola* larvae from those of most other Nematocera.

The larva of *S. alternatus* closely resembles those of *S. fenestralis* and *S. punctatus* described and illustrated in detail by Keilin and Tate (1940). The full-grown larva is 11 to 12 mm long, with a small, well-sclerotized head, three thoracic segments, and eight, similar abdominal segments, and two narrow, tapering terminal segments. There are broad bands of intersegmental membrane connecting the head, thoracic, and first eight abdominal segments so that the larva appears to have 25 segments as shown in Fig. 10.

The head is not as wide as the thoracic segments. It has a broadly V-shaped, dark, posterior margin with two toothlike thickenings ventrally not shown in Keilin and Tate's fig. 16 illustration of the head of *S. fenestralis*. The antenna is short, about as long as wide, and bears two sensory pores. "The presence of two bell-shaped sensory vesicles (on the antenna) is a curious character which appears to be unique amongst dipterous larvae." (Keilin and Tate, 1940, p. 47). Each mandible is two-segmented, the outer segment with two curved teeth and tufts of curved hairs apically, and the basal segment with a conspicuous curved tooth on the inner margin. The three thoracic segments are pinkish purple with two large, circular, lighter areas on the ventral side of each segment. The respiratory system is amphipneustic. Each anterior spiracle has three openings. The two bean-shaped posterior spiracles have about two dozen (23 to 26) tiny openings and are located at the tip of the body between five fleshy lobes. Two tracheal trunks extend anteriorly internally from the spiracles to about the seventh segment, but are less evident further forward. The first eight abdominal segments are similar, but the last two segments are smaller and taper markedly. There is a translucent, shield-shaped saddle partially encircling the eighth segment, which is labeled perianal shield in Fig. 10.

Description of the Pupa

The pupa is about 8 mm long. The wing sheaths enclose the three pairs of leg sheaths. The respiratory horns, or spiracle, appear hemispheric and have narrow bandlike opening across the middle. The abdomen has ten segments. The second to seventh abdominal segments are similar. Each has a ring of small denticles of various sizes near the posterior border and several larger spiniform setae, and six larger spiniform setae, two on each side and two near the midventral surface. The eighth segment has a single row of eight denticles flanked by two spiniform setae and two stout spines on each side. The tenth segment has two terminal spines and a definite concavity between them.

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The authors gratefully acknowledge the generous loan of specimens and helpful advice on many aspects of the article from the following: C. P. Alexander, Amherst, Massachusetts; R. J. Gagné, G. C. Steyskal, Alan Stone (retired), and F. C. Thompson of the Systematic Entomology Laboratory, USDA, Washington, D.C.; L. L. Pechuman of Cornell University, Ithaca, New York; P. J. Clausen of the University of Minnesota, St. Paul; G. W. Byers of the University of Kansas, Lawrence; and W. T. Atyeo of the University of Georgia, Athens.

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NOTICE OF A NEW PUBLICATION

Taxonomic Studies on Fruit Flies of the Genus *Urophora* (Diptera: Tephritidae)

George C. Steyskal

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A key to the world genera of Myopitinae is given, and separate keys to species of the genus *Urophora* of the Palaearctic Region and of the Americas are included. For the Palaearctic Region, 57 species are included in the key; new synonymy is given for two species; and a lectotype is designated for one species. For the Americas, 40 species, including 20 new species, are included in the key; descriptions are given for the new species; and new synonymy is given for two species.

Separate lists of the plant genera used as hosts by *Urophora* species of the two regions are given. There is an index to the genera of insects and host plants and to the species of *Urophora* discussed.

This publication is available for $2.00 and can be ordered from the Custodian, Entomological Society of Washington, % Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.